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|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------|--------------------------------|------------------------|
| APPLICATION NO.                                                                                                                                    | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.            | CONFIRMATION NO.       |
| 10/709,204                                                                                                                                         | 04/21/2004  | Richard S. Wise      | FIS920030028                   | 3203                   |
| 32074 7590 01/04/2007<br>INTERNATIONAL BUSINESS MACHINES CORPORATION<br>DEPT. 18G<br>BLDG. 300-482<br>2070 ROUTE 52<br>HOPEWELL JUNCTION, NY 12533 |             |                      | EXAMINER<br>MALDONADO, JULIO J |                        |
|                                                                                                                                                    |             |                      | ART UNIT<br>2823               | PAPER NUMBER           |
|                                                                                                                                                    |             |                      | MAIL DATE<br>01/04/2007        | DELIVERY MODE<br>PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

**Advisory Action  
Before the Filing of an Appeal Brief**

Application No.

10/709,204

Applicant(s)

WISE ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

**--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

THE REPLY FILED 28 December 2006 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:

- a) ☒ The period for reply expires 4 months from the mailing date of the final rejection.  
b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**NOTICE OF APPEAL**

2. ☐ The Notice of Appeal was filed on \_\_\_\_\_. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

**AMENDMENTS**

3. ☐ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because  
(a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);  
(b) ☐ They raise the issue of new matter (see NOTE below);  
(c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or  
(d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: \_\_\_\_\_. (See 37 CFR 1.116 and 41.33(a)).

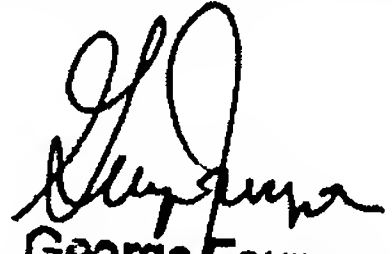
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).  
5. ☐ Applicant's reply has overcome the following rejection(s): \_\_\_\_\_.  
6. ☐ Newly proposed or amended claim(s) \_\_\_\_\_ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).  
7. ☐ For purposes of appeal, the proposed amendment(s): a) ☐ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.  
The status of the claim(s) is (or will be) as follows:  
Claim(s) allowed: \_\_\_\_\_.  
Claim(s) objected to: \_\_\_\_\_.  
Claim(s) rejected: 8 and 10-12.  
Claim(s) withdrawn from consideration: \_\_\_\_\_.

**AFFIDAVIT OR OTHER EVIDENCE**

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).  
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).  
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

**REQUEST FOR RECONSIDERATION/OTHER**

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because:  
See Continuation Sheet.  
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). \_\_\_\_\_.  
13. ☐ Other: \_\_\_\_\_.

  
George Fourson  
Primary Examiner

Continuation of 11. does NOT place the application in condition for allowance because: Applicant's arguments filed 12/28/2006 have been fully considered but they are not persuasive.

Applicants argue, "...Chiang describes an interconnect structure that neither resembles nor bears any similarities to that of Lee and Zhao, and to the wiring structure of the present invention. Specifically, the structure described by Chiang does not include (as evident from Figs.4 and 25 being cited by the Examiner) a plurality of conductors (disposed on a first dielectric layer) that are laterally separated from each other by air gaps and by portions of the first dielectric layer and portions of a second dielectric layer...". In response to this argument, Lee, Zhao and Chiang are directed to the same field of endeavor, namely, interconnect structures in semiconductor integrated circuits. Furthermore, Chiang was not relied upon the recited limitation, that is, "a plurality of conductors...that are laterally separated from each other by air gaps".

Applicants also argue, "...In addition, neither Chiang nor Lee and Zhao provides any description or teaching about how to combine Chiang and that of Lee and Zhao, involving two different structures with different processing procedures, to produce the wiring structure of present invention as specifically required by independent claim 8 of present invention...". In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, as mentioned in the office action mailed 12/16/2006, Lee (Figs.3A-3D) teaches an wiring structure including a first dielectric layer (300, 302), wherein said first dielectric layer (300, 302) further includes an interlayer dielectric (300) and an etch stop layer made of silicon nitride; a plurality of conductors (312) disposed on said first dielectric layer (300, 302), said conductors (312) separated laterally from each other by portions of the first dielectric layer (300, 302) and portions of a second dielectric layer (306) and by air gaps (314), each of the conductors (312) having air gaps (314) adjacent thereto separating the conductor (312) from the first dielectric layer (300, 302) and the second dielectric layer (306); and a third dielectric layer (316) overlying the conductors (312), wherein each of said conductors (312) has a cross-section wider at a top thereof than at a bottom thereof, in accordance with each of the air gaps (314) having a cross-section wider at a bottom thereof than at a top thereof and wherein the first dielectric layer (300, 302) further includes a contacting stud (304) in contact with said conductor (312) (column 1, lines 41 - 52, column 2, lines 18 - 21, and column 4, line 25 - column 5, line 28). Lee fails to disclose wherein said first dielectric layer and said third dielectric layer each have a dielectric constant less than that of the second dielectric layer. However, Zhao (Fig.1A) teaches an interconnect structure including a first dielectric layer (12) having interconnects therein; a metal line (16, 30) formed on said first dielectric layer (12); a second dielectric layer (18) made of SiO<sub>2</sub> or low-k dielectric materials; and a third dielectric layer (26) made of SiO<sub>2</sub> or low-k dielectric materials such as polyimides, parylene and fluoropolymers, wherein said second dielectric layer (18) have air gaps (22) therein (Zhao, column 3, line 54 - column 8, line 60). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Lee and Zhao to enable the second and third dielectric layers of Lee to be made of the materials of Zhao because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable materials for the dielectric layers of Lee and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07. Although the combination of Lee and Zhao teach a third dielectric layer having a dielectric constant lower than that of the second dielectric layer and wherein the first dielectric layer further includes interconnects, the combined teachings of Lee and Zhao fail to disclose wherein the first dielectric layer has a dielectric constant lower than that of the second dielectric layer. However, Chiang (Figs.4 and 25) teaches an interconnect structure formed on substrate (20) including multiple interlayer dielectric layers (22, 23 in Fig.4, and 322, 323 in Fig.25), wherein said multiple interlayer dielectric layer (22, 23) further includes an interlayer dielectric (22) made of SiO<sub>2</sub>, fluoropolymer, polyimides, and an etch stop layer (23) made of either silicon nitride or boron nitride (Chiang, column 6, lines 48 - 65). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Lee and Zhao with Chiang to enable the dielectric layer of the interconnect structure of Lee and Zhao to be made using the materials disclosed in Chiang because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable materials for the first dielectric layer of Lee and Zhao and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Applicants also argue, "...Lee describes a process of using an anti-reflective coating (ARC) layer 302 on top of dielectric layer 300 to improve the photolithographic ability. For that purpose, layers 302 and 300 of Lee may not be made with a single layer of dielectric material. In other words, Lee teaches away from using a single dielectric layer, whether it be dielectric layer 22, 23, 322, or 323 (Figs. 4 and 25 of Chiang), to replace layers 302 and 300, which the Examiner collectively alleges as the "first dielectric layer". On the other hand, Chiang does not teach or suggest any processes that use an ARC layer. Thus, contrary to the allegation made by the Examiner, Applicants respectfully submit that Chiang cannot be combined with Lee and Zhao to make the "first dielectric layer", which includes layers 302 and 300, using dielectric materials disclosed by Chiang...". In response to this argument, in the office action mailed 10/16/2006, the labeled 'first dielectric layer' in Lee corresponds to layers 300 and 302, made of silicon dioxide and silicon oxynitride, respectively. On the other hand, the labeled 'first dielectric layer' in Chiang corresponds to layers 22 and 23 (Fig.4) or layer 322 and 323 (Fig.25), wherein the first dielectric layer is made of SiO<sub>2</sub> or low-k dielectric materials (Chiang, column 13, lines 26 - 35) and wherein the second dielectric layer is made of either silicon nitride, boron nitride, silicon carbide and silicon oxynitride (Chiang, column 14, line 66 - column 15, line 5). Furthermore, applicants assert that Chiang is silent in regards to using silicon oxynitride as an ARC layer but Chiang was not relied upon that limitation or function.

Applicants also argue, "...Lee, Zhao, and Chiang does not cure the deficiency of teaching the alleged first dielectric layer (including both layer 302 and layer 300) having a dielectric constant less than that of the alleged second dielectric layer 306, and specifically required by independent claim 8...". In response to this argument, Lee teaches a first dielectric layer (300, 302), a second dielectric layer (306) and a third dielectric layer (316), and wherein a portion of said first dielectric layer (300), said second dielectric layer (306) and said

third dielectric layer (316) are open to any dielectric material, and furthermore, another portion (302) of said first dielectric layer is open to any material as long as it has antireflective properties. Zhao and Chiang were relied on a multi-level wiring structure having first, second and third dielectric layers, and wherein said first second and third dielectric layers are made of materials selected from conventional silicon oxide to low-dielectric materials. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the materials disclosed in Zhao and Chiang in Lee because art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07. It would also have been obvious to one of ordinary skill in the art at the time the invention was made to arrive at the claimed combination of dielectric layers having the disclosed dielectric constant relationship through routinary experimentation and because it is prima facie obvious to combine equivalents known for the same purpose. MPEP 2144.06. Furthermore, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See Ex parte Obiaya, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).